

Network Working Group

Internet-Draft

Updates: [6841](#), [8182](#) (if approved)

Intended status: Standards Track Internet Initiative Japan & Arrcus, Inc.

Expires: October 27, 2020

T. Bruijnzeels

NLnet Labs

R. Bush

G. Michaelson

APNIC

April 25, 2020

**Resource Public Key Infrastructure (RPKI) Repository Requirements  
draft-sidrops-bruijnzeels-deprecate-rsync-01**

**Abstract**

This document formulates a plan of a phased transition to a state where RPKI repositories and Relying Party software performing RPKI Validation will use the RPKI Repository Delta Protocol (RRDP) [[RFC8182](#)] as the only mandatory to implement access protocol.

In short this plan consists of the following phases.

In phase 0, today's deployment, RRDP is supported by most, but not all Repositories, and most but not all RP software.

In the proposed phase 1 RRDP will become mandatory to implement for Repositories, in addition to rsync. This phase can start as soon as this document is published.

Once the proposed updates are implemented by all Repositories phase 2 will start. In this phase RRDP will become mandatory to implement for all RP software, and rsync must no longer be used.

Measurements will need to be done to help determine when it will be safe to transition to the final phase of this plan. During this phase Repositories will no longer be required to provide rsync access for RPKI validation purposes. However, they may still provide rsync access for direct access to files for other purposes, if desired, at a best effort basis.

Although this document currently includes descriptions and updates to RFCs for each of these phases, we may find that it will be beneficial to have separate documents for the plan, and each phase, so that it might be more clear to all when the updates to RFCs take effect.

## Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on October 27, 2020.

## Copyright Notice

Copyright (c) 2020 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

|                        |  |                   |
|------------------------|--|-------------------|
| <a href="#">1.</a>     | Requirements notation . . . . .  | <a href="#">3</a> |
| <a href="#">2.</a>     | Motivation . . . . .   | <a href="#">3</a> |
| <a href="#">3.</a>     | Plan . . . . .   | <a href="#">4</a> |
| 3.1.                   | Phase 0 - RPKI repositories support rsync, and optionally RRDP . . . . . | <a href="#">4</a> |
| 3.2.                   | Phase 1 - RPKI repositories support both rsync and RRDP . . . . .        | 4                 |
| <a href="#">3.2.1.</a> | Current Support for RRDP in Repository Software . . . . .                | <a href="#">4</a> |
| <a href="#">3.2.2.</a> | Updates to <a href="#">RFC 6481</a> . . . . .                            | <a href="#">5</a> |
| <a href="#">3.2.3.</a> | Measurements . . . . .   | <a href="#">6</a> |
| <a href="#">3.3.</a>   | Phase 2 - All RP software prefers RRDP . . . . .                         | <a href="#">6</a> |
| <a href="#">3.3.1.</a> | RRDP support in Relying Party software . . . . .                         | <a href="#">6</a> |
| <a href="#">3.3.2.</a> | Updates to <a href="#">RFC 8182</a> . . . . .                            | <a href="#">6</a> |
| <a href="#">3.3.3.</a> | Measurements . . . . .   | <a href="#">7</a> |
| 3.4.                   | Phase 3 - RPKI repositories support RRDP, and optionally                 |                   |



|   |                    |
|---|--------------------|
| rsync . . . . .   | <a href="#">7</a>  |
| <a href="#">3.4.1</a> . Updates to <a href="#">RFC 6481</a> . . . . . | <a href="#">7</a>  |
| <a href="#">4</a> . Rsync URIs as object identifiers . . . . .        | <a href="#">8</a>  |
| <a href="#">5</a> . IANA Considerations . . . . .                     | <a href="#">9</a>  |
| <a href="#">6</a> . Security Considerations . . . . .                 | <a href="#">9</a>  |
| <a href="#">7</a> . Acknowledgements . . . . .                        | <a href="#">9</a>  |
| <a href="#">8</a> . Normative References . . . . .                    | <a href="#">9</a>  |
| Authors' Addresses . . . . .  | <a href="#">10</a> |

## [1](#). Requirements notation

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#) [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

## [2](#). Motivation

The Resource Public Key Infrastructure (RPKI) [[RFC6480](#)] as originally defined uses rsync as its distribution protocol, as outlined in [[RFC6481](#)]. Later, the RPKI Repository Delta Protocol (RRDP) [[RFC8182](#)] was designed to provide an alternative. In order to facilitate incremental deployment RRDP has been deployed as an additional optional protocol, while rsync was still mandatory to implement.

A number of issues observed with rsync motivated the design of RRDP, e.g.:

- o rsync is CPU and memory heavy, and easy to DoS
- o rsync library support is lacking
- o rsync makes it somewhat difficult to publish sets of object atomically

RRDP was designed to leverage HTTPS CDN infrastructure to provide RPKI Repository content in a resilient way, while reducing the load on the Repository server. It supports that updates are published as atomic deltas, which can help prevent most of the issues described in [section 6 of](#) [[RFC6486](#)].

For a longer discussion please see [section 1 of](#) [[RFC8182](#)].

In conclusion: we believe that RRDP is the better solution. Therefore, this document outlines a transition plan where RRDP



becomes mandatory to implement, and rsync becomes optional and eventually deprecated.

### **3. Plan**

Changing the RPKI infrastructure to rely on RRDP instead of rsync is a delicate operation. There is current deployment of Certification Authorities, Repository Servers and Relying Party software which relies on rsync, and which may not yet support RRDP.

Therefore we need to have a plan that ultimately updates the relevant RFCs, but which uses a phased approach combined with measurements to limit the operational impact of doing this to (almost) zero.

The general outline of the plan is as follows. We will describe each step in more detail below.

| +-----+-----+-----+-----+-----+-----+ |  |
|---------------------------------------|--|
| Phase                                 | Description  |
| +-----+-----+-----+-----+-----+-----+ |  |
| 0                                     | RPKI repositories support rsync, and optionally RRDP |
| 1                                     | RPKI repositories support both rsync and RRDP        |
| 2                                     | All RP software prefers RRDP                         |
| 3                                     | RPKI repositories support RRDP, and optionally rsync |
| +-----+-----+-----+-----+-----+-----+ |  |

#### **3.1. Phase 0 - RPKI repositories support rsync, and optionally RRDP**

This is the situation at the time of writing this document. Relying Parties can prefer RRDP over rsync today, but they need to support rsync until all RPKI repositories support RRDP. Therefore all repositories should support RRDP at their earliest convenience.

#### **3.2. Phase 1 - RPKI repositories support both rsync and RRDP**

During this phase we will make RRDP mandatory to support for Repository Servers, and measure whether the deployed Repository Servers have been upgraded to do so, in as far as they don't support RRDP already.

##### **3.2.1. Current Support for RRDP in Repository Software**

The currently known support for RRDP for repositories is as follows:



| Repository Implementation |  | Support for RRDP |
|---------------------------|--|------------------|
| afrinic                   |  | yes              |
| apnic                     |  | yes              |
| arin                      |  | yes              |
| lacnic                    |  | planned          |
| ripe ncc                  |  | yes              |
| Dragon Research Labs      |  | yes(1,2)         |
| krill                     |  | yes(1)           |

(1) in use at various National Internet Registries, as well as other resource holders under RIRs. (2) not all organizations using this software have upgraded to using RRDP.

### 3.2.2. Updates to [RFC 6481](#)

During this phase the updates are applied to [section 3 of \[RFC6481\]](#).

OLD:

- o The publication repository SHOULD be hosted on a highly available service and high-capacity publication platform.
- o The publication repository MUST be available using rsync [\[RFC5781\]](#) [RSYNC]. Support of additional retrieval mechanisms is the choice of the repository operator. The supported retrieval mechanisms MUST be consistent with the accessMethod element value(s) specified in the SIA of the associated CA or EE certificate.

NEW:

- o The publication repository MUST be available using the RPKI Repository Delta Protocol [\[RFC8182\]](#). The RRDP server SHOULD be hosted on a highly available platform.
- o The publication repository MUST be available using rsync [\[RFC5781\]](#) [RSYNC]. The rsync server SHOULD be hosted on a highly available platform.
- o Support of additional retrieval mechanisms is the choice of the repository operator. The supported retrieval mechanisms MUST be consistent with the accessMethod element value(s) specified in the SIA of the associated CA or EE certificate.





### 3.2.3. Measurements

We can find out whether all RPKI repositories support RRDP by running (possibly) modified Relying Party software that keeps track of this.

When it is found that Repositories do not yet support RRDP, outreach should be done to them individually. Since the number of Repositories is fairly low, and it is in their interest to run RRDP because it addresses availability concerns, we have confidence that we will find these Repositories willing to make changes.

### 3.3. Phase 2 - All RP software prefers RRDP

Once all Repositories support RRDP we can proceed to make RRDP mandatory to implement for Relying Party software.

#### 3.3.1. RRDP support in Relying Party software

The currently known support for RRDP in Relying Party software is as follows:

| Relying Party Implementation | RRDP | version | since    |
|------------------------------|------|---------|----------|
| FORT                         | yes  | ?       | ?        |
| OctoRPKI                     | yes  | ?       | ?        |
| rcynic                       | yes  | ?       | ?        |
| RIPE NCC RPKI Validator 2.x  | yes  | ?       | ?        |
| RIPE NCC RPKI Validator 3.x  | yes  | ?       | ?        |
| Routinator                   | yes  | 0.6.0   | Sep 2019 |
| rpki-client                  | no   | ?       | ?        |
| RPSTIR                       | yes  | ?       | ?        |

The authors kindly request Relying Party software implementers to let us know in which version of their tool support for RRDP was introduced, and when that version was released.

#### 3.3.2. Updates to [RFC 8182](#)

From this phase onwards the updates are applied to [section 3.4.1 of \[RFC8182\]](#).

OLD: When a Relying Party performs RPKI validation and learns about a valid certificate with an SIA entry for the RRDP protocol, it SHOULD use this protocol as follows.



NEW: When a Relying Party performs RPKI validation and learns about a valid certificate with an SIA entry for the RRDP protocol, it MUST use this protocol. It MUST NOT depend on object retrieval for this certificate over rsync for validation, although it MAY still use rsync access for other purposes under the understanding that availability is not guaranteed.

### **3.3.3. Measurements**

Although the tools may support RRDP, users will still need to install updated versions of these tools in their infrastructure. Any Repository operator can measure this transition by observing access to their RRDP and rsync repositories respectively.

But even after new versions have been available, it is expected that there will be long, low volume, tail of users who did not upgrade and still depend on rsync.

It is hard to quantify here now, what would be an acceptable moment to conclude that it's safe to move to the next phase and make rsync optional. A parallel to the so-called DNS Flag Day comes to mind.

### **3.4. Phase 3 - RPKI repositories support RRDP, and optionally rsync**

The end goal of this phase is that there will be no operational dependencies on rsync for Repositories, although they MAY still choose to operate rsync at a best effort basis.

#### **3.4.1. Updates to [RFC 6481](#)**

From this phase onwards these updates are applied to [section 3 of \[\\[RFC6481\\]\]\(#\)](#) as it was updated during Phase 2 described above:

OLD:

- o The publication repository MUST be available using the RPKI Repository Delta Protocol [[RFC8182](#)]. The RRDP server SHOULD be hosted on a highly available platform.
- o The publication repository MUST be available using rsync [[RFC5781](#)] [RSYNC]. The rsync server SHOULD be hosted on a highly available platform.
- o Support of additional retrieval mechanisms is the choice of the repository operator. The supported retrieval mechanisms MUST be consistent with the accessMethod element value(s) specified in the SIA of the associated CA or EE certificate.



NEW:

- o The publication repository **MUST** be available using the RPKI Repository Delta Protocol [[RFC8182](#)]. The RRDP server **SHOULD** be hosted on a highly available platform.
- o The publication repository **MAY** be available using rsync [[RFC5781](#)] [RSYNC].
- o Support of additional retrieval mechanisms is the choice of the repository operator. The supported retrieval mechanisms **MUST** be consistent with the accessMethod element value(s) specified in the SIA of the associated CA or EE certificate.

#### **4. Rsync URIs as object identifiers**

If and when RPKI Repositories no longer need to support rsync, this begs the question whether rsync should still be used in URIs used in RPKI objects.

[RFC6481] defines a profile for the Resource Certificate Repository Structure. In this profile objects are identified through rsync URIs. E.g. a CA certificate has an Subject Information Access descriptor which uses an rsync URI to identify its manifest [[RFC6486](#)]. The manifest enumerates the relative names and hashes for all objects published under the private key of the CA certificate. The full rsync URI identifiers for each object can be resolved relative to the manifest URI.

Though it would be possible in principle to build up an RPKI tree hierarchy of objects based on key identifiers and hashes [[RFC8488](#)], most Relying Party implementations have found it very useful to use rsync URIs for this purpose. Furthermore, these identifiers make it much easier to name object in case of validation problems, which help operators to address issues.

For these reasons, RRDP still includes rsync URIs in the definition of the publish, update and withdraw elements in the snapshot and delta files that it uses. See [section 3.5 of \[RFC8182\]](#). Thus, objects retrieved through RRDP can be mapped easily to files and URIs, similar to as though rsync would have been used to retrieve them.

Even though objects are no longer guaranteed to be available over rsync, we still use rsync as the mandatory scheme in the CRL Distribution Points, Authority Information Access, and Subject Information Access defined in [[RFC6487](#)]. Changing this would introduce breaking changes which make deployment very hard indeed: we



would need to invent an alternative naming scheme, which would need to be supported by all Relying Parties, before Certification Authorities can issue any certificate or RPKI signed objects using these schemes.

Furthermore, it is very convenient to have direct access to RPKI objects using rsync for troubleshooting, debugging and research purposes. Therefore Repository operators MAY still choose to make an rsync repository available for these purposes.

## **5. IANA Considerations**

This document has no IANA actions.

## **6. Security Considerations**

TBD

## **7. Acknowledgements**

TBD

## **8. Normative References**

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<https://www.rfc-editor.org/info/rfc2119>>.
- [RFC5781] Weiler, S., Ward, D., and R. Housley, "The rsync URI Scheme", [RFC 5781](#), DOI 10.17487/RFC5781, February 2010, <<https://www.rfc-editor.org/info/rfc5781>>.
- [RFC6480] Lepinski, M. and S. Kent, "An Infrastructure to Support Secure Internet Routing", [RFC 6480](#), DOI 10.17487/RFC6480, February 2012, <<https://www.rfc-editor.org/info/rfc6480>>.
- [RFC6481] Huston, G., Loomans, R., and G. Michaelson, "A Profile for Resource Certificate Repository Structure", [RFC 6481](#), DOI 10.17487/RFC6481, February 2012, <<https://www.rfc-editor.org/info/rfc6481>>.
- [RFC6486] Austein, R., Huston, G., Kent, S., and M. Lepinski, "Manifests for the Resource Public Key Infrastructure (RPKI)", [RFC 6486](#), DOI 10.17487/RFC6486, February 2012, <<https://www.rfc-editor.org/info/rfc6486>>.





- [RFC6487] Huston, G., Michaelson, G., and R. Loomans, "A Profile for X.509 PKIX Resource Certificates", [RFC 6487](#), DOI 10.17487/RFC6487, February 2012, <<https://www.rfc-editor.org/info/rfc6487>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in [RFC 2119](#) Key Words", [BCP 14](#), [RFC 8174](#), DOI 10.17487/RFC8174, May 2017, <<https://www.rfc-editor.org/info/rfc8174>>.
- [RFC8182] Bruijnzeels, T., Muravskiy, O., Weber, B., and R. Austein, "The RPKI Repository Delta Protocol (RRDP)", [RFC 8182](#), DOI 10.17487/RFC8182, July 2017, <<https://www.rfc-editor.org/info/rfc8182>>.
- [RFC8488] Muravskiy, O. and T. Bruijnzeels, "RIPE NCC's Implementation of Resource Public Key Infrastructure (RPKI) Certificate Tree Validation", [RFC 8488](#), DOI 10.17487/RFC8488, December 2018, <<https://www.rfc-editor.org/info/rfc8488>>.

#### Authors' Addresses

Tim Bruijnzeels  
NLnet Labs

Email: [tim@nlnetlabs.nl](mailto:tim@nlnetlabs.nl)  
URI: <https://www.nlnetlabs.nl/>

Randy Bush  
Internet Initiative Japan & Arrcus, Inc.

Email: [randy@psg.com](mailto:randy@psg.com)

George Michaelson  
APNIC

Email: [ggm@apnic.net](mailto:ggm@apnic.net)  
URI: <http://www.apnic.net>

